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Hydrostratigraphic Analysis Used to Optimize Ground Water Remediation at the Lawrence Livermore National Laboratory Superfund Site

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Lawrence Livermore National Laboratory (LLNL), a Superfund site near Livermore, California, is underlain by 300-400 ft of heterogeneous alluvial sediments. The ground water in these sediments contains multiple plumes of contaminants consisting predominantly of volatile organic compounds (VOCs). To better evaluate the hydrogeologic factors controlling subsurface flow and transport of VOCs for the design and implementation of remediation systems, we subdivided the subsurface into hydrostratigraphic units (HSUs). The HSUs have similar hydraulic characteristics based on a methodical analysis of lithology, structure, geophysical logs, VOC distributions, aquifer tests, and water levels. We constructed maps and cross sections showing the changes in the plumes through time. To aid in well field design, these maps and cross sections were then analyzed with respect to hydrogeologic factors, such as hydraulic gradients and geometry of the high-permeability pathways within each HSU.

This approach enables us to better position extraction wells and piezometers to optimize VOC mass removal and ensure adequate hydraulic capture of the VOC plumes. We reduced the number of wells originally proposed for the site by demonstrating to the regulatory agencies the hydraulic communication within the HSUs. This work has also provided input parameters to a 3D numerical model and assisted in evaluating the feasibility of using new, innovative technologies at the site. Such subsurface characterization allows us to better evaluate the effectiveness of the ground water cleanup program and reduce long-term closure costs while meeting the requirements of the Record of Decision for the site.

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